

## CLAIMS

What is claimed is:

1. A multi-services access system (e.g., 205 in Fig. 2) for a telecommunication network, comprising:
  - (a) a packet-mode card (e.g., 209) capable of being coupled to one or more local derived-signal customer premises equipment (CPE) units (e.g., 131) to (1) receive upstream packetized data signals and upstream packetized derived signals from the one or more local packet-mode CPE units and (2) transmit downstream packetized data signals and downstream packetized derived signals to the one or more local packet-mode CPE units;
  - (b) a packet interface (e.g., 211) capable of being coupled to a packet-switched network (e.g., 119) to (1) transmit upstream packetized data signals and downstream packetized derived signals to the packet-switched network and (2) receive downstream packetized data signals and upstream packetized derived signals from the packet-switched network;
  - (c) a circuit interface (e.g., 217) capable of being coupled to a circuit-switched network (e.g., 125) to (1) transmit upstream digital streams to the circuit-switched network and (2) receive downstream digital streams from the circuit-switched network;
  - (d) a controller (e.g., 215) coupled to the circuit interface; and
  - (e) a derived-signal server (e.g., 219) coupled to the packet-mode card, the packet interface, and the controller, wherein:
    - the packet-mode card forwards each received upstream packetized data signal to the packet interface for transmission to the packet-switched network;
    - the packet interface forwards each received downstream packetized data signal destined for a local packet-mode CPE unit to the packet-mode card for transmission to the local packet-mode CPE unit;
    - the packet-mode card and the packet interface both forward each corresponding received upstream packetized derived signal to the derived-signal server, which converts the upstream packetized derived signal into an upstream digital stream and forwards the upstream digital stream to the controller, which forwards the upstream digital stream to the circuit interface, which transmits the upstream digital stream to the circuit-switched network; and
    - the circuit interface forwards each received downstream digital stream to the controller, wherein:
      - if the downstream digital stream is destined for a local packet-mode CPE unit, then the controller forwards the downstream digital stream to the derived-signal server, the derived-signal server converts the downstream digital stream into a downstream packetized derived signal and forwards the downstream packetized derived signal to the packet-mode card, which transmits the downstream packetized derived signal to the local packet-mode CPE unit; and

33 if the downstream digital stream is destined for a remote packet-mode CPE unit (e.g., 143), then  
34 the controller forwards the downstream digital stream to the derived-signal server, the derived-signal  
35 server converts the downstream digital stream into a downstream packetized derived signal and forwards  
36 the downstream packetized derived signal to the packet interface, which transmits the downstream  
37 packetized derived signal to the packet-switched network for routing to the remote packet-mode CPE  
38 unit.

1 2. The invention of claim 1, wherein the access system does not have individual dedicated resources  
2 for each local packet-mode CPE unit.

1 3. The invention of claim 1, wherein the access system dynamically allocates, in real time, system  
2 resources for each local packet-mode CPE unit.

1 4. The invention of claim 1, further comprising a circuit-mode card (e.g., 213) coupled to the  
2 controller and capable of being coupled to one or more circuit-mode CPE units (e.g., 121) to (1) receive  
3 upstream circuit-mode signals from the one or more circuit-mode CPE units and (2) transmit downstream  
4 circuit-mode signals to the one or more circuit-mode CPE units, wherein:

5 the circuit-mode card converts each upstream circuit-mode signal into an upstream digital stream and  
6 forwards the upstream digital stream to the controller, which forwards the upstream digital stream to the  
7 circuit interface, which transmits the upstream digital stream to the circuit-switched network; and

8 if a downstream digital stream received by the controller from the circuit interface is destined for a  
9 circuit-mode CPE unit, then the controller forwards the downstream digital stream to the circuit-mode  
10 card, which converts the downstream digital stream into a downstream circuit-mode signal and transmits  
11 the downstream circuit-mode signal to the circuit-mode CPE unit.

1 5. The invention of claim 4, wherein the circuit-mode card is further coupled to the packet-mode  
2 card, wherein the packet-mode card is capable of being coupled to one or more combined circuit/packet-  
3 mode CPE units (e.g., 107) to (1) receive upstream combined circuit/packet-mode signals from the one or  
4 more combined circuit/packet-mode CPE units and (2) transmit downstream combined circuit/packet-  
5 mode signals to the one or more combined circuit/packet-mode CPE units, wherein:

6 the packet-mode card separates each upstream combined circuit/packet-mode signal received from a  
7 combined circuit/packet-mode CPE unit into an upstream packetized data signal and an upstream circuit-  
8 mode signal, wherein:

9 the packet-mode card forwards the upstream packetized data signal to the packet interface, which  
10 transmits the upstream packetized data signal to the packet-switched network; and  
11 the packet-mode card forwards the upstream circuit-mode signal to the circuit-mode card, which  
12 converts the upstream circuit-mode signal into an upstream digital stream and forwards the upstream  
13 digital stream to the controller, which forwards the upstream digital stream to the circuit interface, which  
14 transmits the upstream digital stream to the circuit-switched network;  
15 if a downstream packetized data signal received by the packet interface from the packet-switched  
16 network is destined for a combined circuit/packet-mode CPE unit, then the packet interface forwards the  
17 downstream packetized data signal to the packet-mode card, which combines the downstream packetized  
18 data signal with any corresponding downstream circuit-mode signal and transmits the resulting  
19 downstream combined circuit/packet-mode signal to the combined circuit/packet-mode CPE unit; and  
20 if a downstream digital stream received by the controller from the circuit interface is destined for a  
21 combined circuit/packet-mode CPE unit, then the controller forwards the downstream digital stream to  
22 the circuit-mode card, which converts the downstream digital stream into a downstream circuit-mode  
23 signal and transmits the downstream circuit-mode signal to the packet-mode card, which combines the  
24 downstream circuit-mode signal with any corresponding downstream packetized data signal and  
25 transmits the resulting downstream combined circuit/packet-mode signal to the combined circuit/packet-  
26 mode CPE unit.

1 6. The invention of claim 5, wherein:  
2 the multi-services access system is a multi-services digital loop carrier (DLC) system;  
3 the packet-mode card is digital subscriber line (DSL) line card;  
4 the circuit-mode card is a voice card;  
5 the one or more circuit-mode CPE units are telephones;  
6 the one or more local and remote packet-mode CPE units and the one or more combined  
7 circuit/packet CPE units are DSL CPE units;  
8 the packetized derived signals comprise packetized derived voice signals;  
9 the DLC system does not have individual dedicated resources for each local packet-mode CPE unit;  
10 and  
11 the DLC system dynamically allocates, in real time, system resources for each local packet-mode  
12 CPE unit.

1 7. A method for processing signals in a multi-services access system for a telecommunication  
2 network, the access system capable of being coupled directly to one or more local packet-mode CPE  
3 units, a packet-switched network, and a circuit-switched network, comprising the steps of:

4 (a) transmitting each upstream packetized data signal received from a local packet-mode CPE unit to  
5 the packet-switched network;

6 (b) if a downstream packetized data signal received from the packet-switched network is destined for  
7 a local packet-mode CPE unit, then transmitting the downstream packetized data signal to the local  
8 packet-mode CPE unit;

9 (c) converting each upstream packetized derived signal received from either a local packet-mode  
10 CPE unit or the packet-switched network into an upstream digital stream and transmitting the upstream  
11 digital stream to the circuit-switched network;

12 (d) if a downstream digital stream received from the circuit-switched network is destined for a local  
13 packet-mode CPE unit, then converting the downstream digital stream into a downstream packetized  
14 derived signal and transmitting the downstream packetized derived signal to the local packet-mode CPE  
15 unit; and

16 (e) if a downstream digital stream received from the circuit-switched network is destined for a  
17 remote packet-mode CPE unit, then converting the downstream digital stream into a downstream  
18 packetized derived signal and transmitting the downstream packetized derived signal to the packet-  
19 switched network for routing to the remote packet-mode CPE unit.

1 8. The invention of claim 7, wherein the access system does not have individual dedicated resources  
2 for each local packet-mode CPE unit.

1 9. The invention of claim 7, wherein the access system dynamically allocates, in real time, system  
2 resources for each local packet-mode CPE unit.

1 10. The invention of claim 7, wherein the access system is further capable of being coupled to one or  
2 more circuit-mode CPE units and further comprising the steps of:

3 (f) converting each upstream circuit-mode signal received from a circuit-mode CPE unit into an  
4 upstream digital stream and transmitting the upstream digital stream to the circuit-switched network; and

5 (g) if a downstream digital stream received from the circuit interface is destined for a circuit-mode  
6 CPE unit, then converting the downstream digital stream into a downstream circuit-mode signal and  
7 transmitting the downstream circuit-mode signal to the circuit-mode CPE unit.

1 11. The invention of claim 10, wherein the access system is further capable of being coupled to one  
2 or more combined circuit/packet-mode CPE units and further comprising the steps of:

3 (h) separating each upstream combined circuit/packet-mode signal received from a combined  
4 circuit/packet-mode CPE unit into an upstream packetized data signal and an upstream circuit-mode  
5 signal;

6 (i) transmitting the upstream packetized data signal to the packet-switched network;

7 (j) converting the upstream circuit-mode signal into an upstream digital stream and transmitting the  
8 upstream digital stream to the circuit-switched network;

9 (k) if a downstream packetized data signal received from the packet-switched network is destined for  
10 a combined circuit/packet-mode CPE unit, then combining the downstream packetized data signal with  
11 any corresponding downstream circuit-mode signal and transmitting the resulting downstream combined  
12 circuit/packet-mode signal to the combined circuit/packet-mode CPE unit; and

13 (l) if a downstream digital stream received from the circuit-switched network is destined for a  
14 combined circuit/packet-mode CPE unit, then converting the downstream digital stream into a  
15 downstream circuit-mode signal, combining the downstream circuit-mode signal with any corresponding  
16 downstream packetized data signal, and transmitting the resulting downstream combined circuit/packet-  
17 mode signal to the combined circuit/packet-mode CPE unit.

1 12. The invention of claim 11, wherein:

2 the multi-services access system is a multi-services digital loop carrier (DLC) system;

3 the one or more circuit-mode CPE units are telephones;

4 the one or more local and remote packet-mode CPE units and the one or more combined  
5 circuit/packet CPE units are DSL CPE units;

6 the packetized derived signals comprise packetized derived voice signals;

7 the DLC system does not have individual dedicated resources for each local packet-mode CPE unit;

8 and

9 the DLC system dynamically allocates, in real time, system resources for each local packet-mode  
10 CPE unit.

1 13. A method for processing signals in a multi-services access system for a telecommunication  
2 network, comprising the steps of:

3 (a) receiving packetized data signals and packetized derived signals from a packet-mode CPE unit;

4 (b) determining whether each packet received from the packet-mode CPE unit is a data packet or a  
5 derived packet;

6 (c) transmitting each data packet from the packet-mode CPE unit directly to a packet-switched  
7 network for packet-based switching; and

8 (d) converting each derived packet from the packet-mode CPE unit into a digital stream and  
9 transmitting the digital stream directly to a circuit-switched network for circuit-based switching.

1 14. The invention of claim 13, wherein the access system does not have individual dedicated  
2 resources for the packet-mode CPE unit.

1 15. The invention of claim 13, wherein the access system dynamically allocates, in real time, system  
2 resources for the packet-mode CPE unit.

1 16. The invention of claim 13, further comprising the steps of:

2 (e) receiving a digital stream directly from the circuit-switched network;

3 (f) converting the digital stream into a packetized derived signal; and

4 (g) transmitting the packetized derived signal to the packet-mode CPE unit.

1 17. The invention of claim 13, wherein the access system enables the packet-mode CPE unit to  
2 transmit and receive packetized derived signals to and from the circuit-switched network without using  
3 any packet-switched network and without using any external gateway interconnecting the circuit-  
4 switched network and a packet-switched network.

1 18. The invention of claim 13, wherein:

2 the multi-services access system is a multi-services digital loop carrier (DLC) system;

3 the packet-mode CPE unit is a DSL CPE unit; and

4 the packetized derived signals comprise packetized derived voice signals.